Feb. 17, 1970 A. TUMA 3,495,932

METHOD AND A DEVICE FOR REMOVING LIQUID IN AN ASEPTIC WAY FROM A WEB-SHAPED PACKAGING MATERIAL

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Fig.1

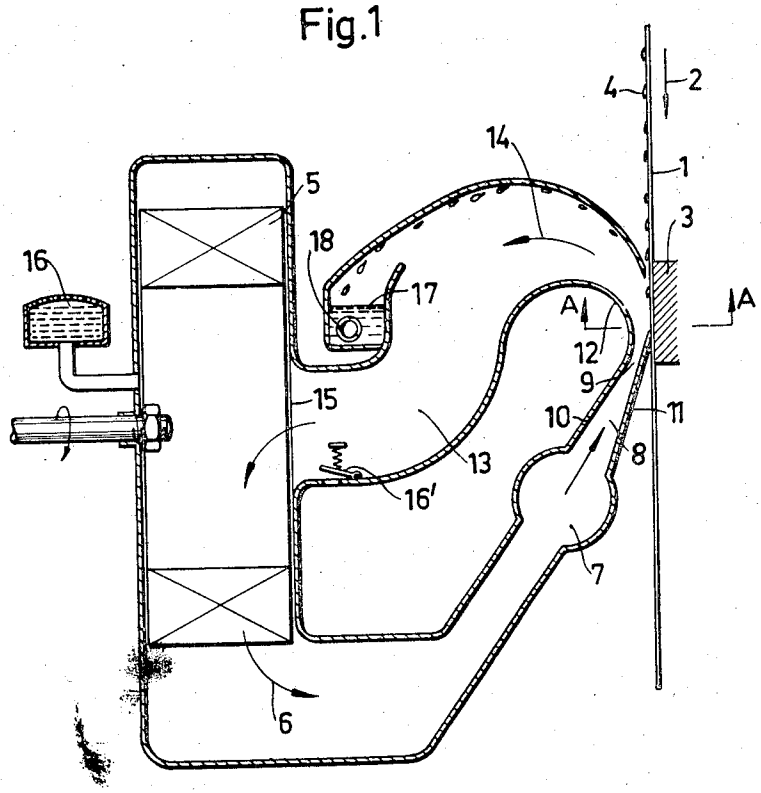

Fig.2

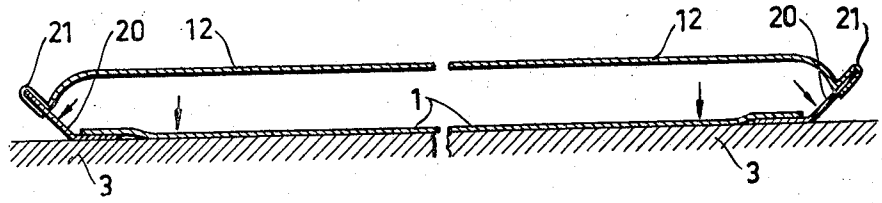

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Fig. 3a

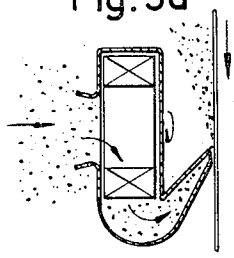

Fig. 3b

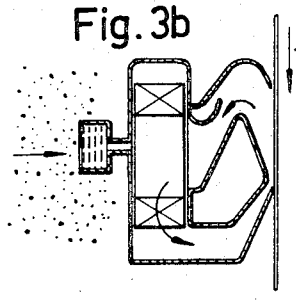

Fig. 4

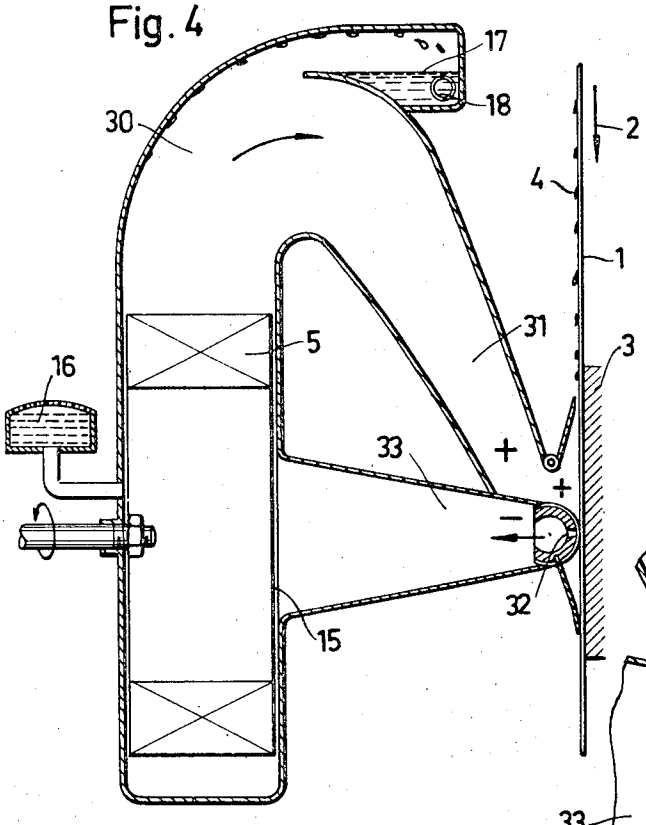

Fig. 5

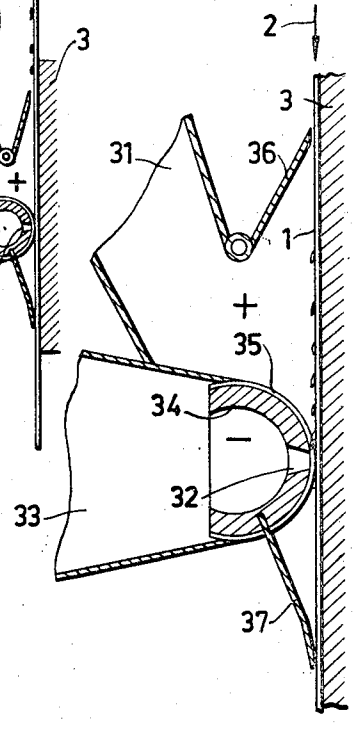

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Fig. 6

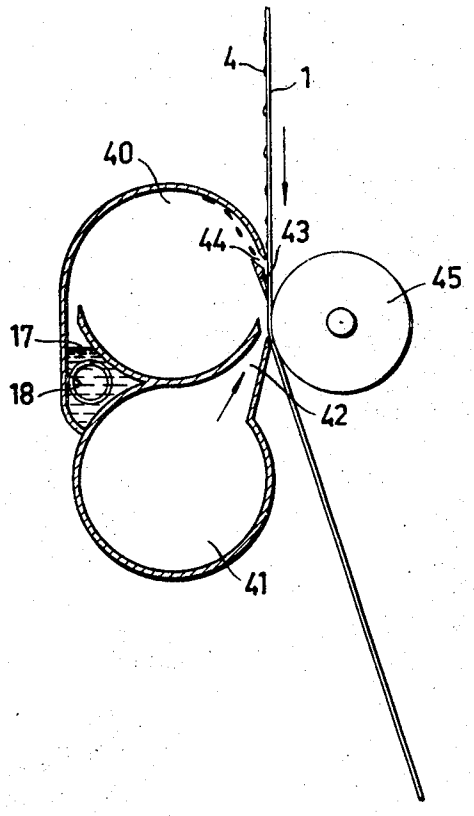
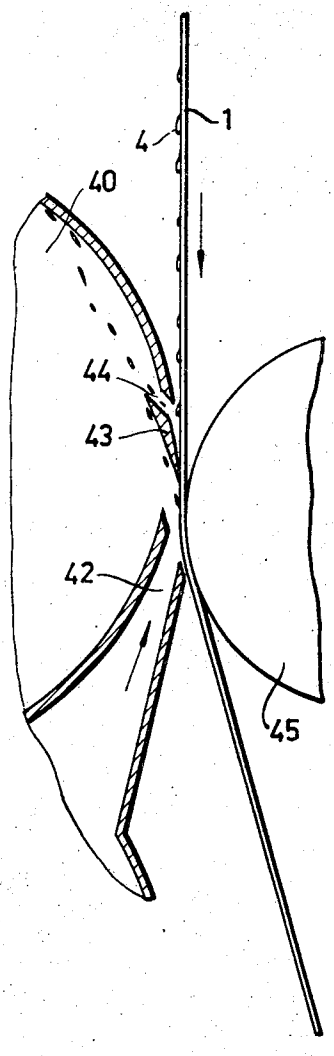


Fig. 7



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3,495,932

METHOD AND A DEVICE FOR REMOVING LIQUID IN AN ASEPTIC WAY FROM A WEB-SHAPED PACKAGING MATERIAL

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U.S. Cl. 21—2 5 Claims

ABSTRACT OF THE DISCLOSURE

A method of removing sterilizing liquid from the surface of a moving web of material without contaminating such surface. The method entails directing a blast of sterile gas across the full face of the sterilized surface to remove droplets of sterilizing liquid therefrom.

The present invention refers to the chemical sterilization of a packaging material by means of a liquid and refers more particularly to a method and a device for removing the sterilization liquid from the packaging material after completed sterilization.

In the chemical sterilization of web-shaped packaging materials the removal of the liquid used at the sterilization has represented a problem for a long time. Sterilization of the material is generally carried out in connection with the forming and filling of the packages, at least the parts of the packaging material which are intended to form the inner side of the finished package being allowed to come into contact with the sterilization liquid. For example, this may be performed such that the web material is carried through a bath, that the surface of the material is brushed by means moistened with sterilization liquid or that the liquid is sprayed onto the surface.

Whatever method is chosen, the problem of completely removing the sterilization liquid from the surface of material, before the packages are filled, always arises. When the packaging machine operates at a high speed, the liquid does not have time to evaporate during the short period of time available. More particularly this is the case when the liquid forms droplets on the surface of the packaging material. Special measures must therefore be taken for removing the liquid.

In a prior method the web material is allowed to pass between two rubber rolls, liquid droplets present on the surface of the material being squeezed away by the rolls. The method involves considerable drawbacks. In the first place, the method does not satisy high demands on sterility. Furthermore, by the braking influence of the rolls severe tensions arise in the packaging material, and finally the rolls guide the material in an undesirable way in the transverse direction, said guiding being dependent on mechanical or physical variations in the packaging material.

Another prior method consists in the use of a strip of hard or soft material to scrape off the liquid from the web of material. The hard construction causes considerable difficulties in obtaining a smooth engagement between the strip or scrape and the web of material across the whole width of the latter and thereby also a smooth scraping-off of the liquid. In the soft construction, for example a rubber-like material, the soft material is worn off extremely quickly from the edges of the web of material, said edges acting as knives or saws. In the case of improper surface tensions in the sterilization liquid a scrape, whether made from a hard or a soft material, may besides accumulate the liquid in the slot between one

surface of the scrape and the web of material, whereupon larger liquid droplets are periodically carried away.

The present invention refers to a method and a device for removing liquid in an aseptic way from a web-shaped packaging material without causing pulling in the web material, characterized by the fact that the liquid is blown or drawn away from the web material by means of a sterile gas, for example sterile air, along a line extending from one lateral edge of the material to the other, at the same time as the web material is introduced into a packaging machine.

Further characteristics of the invention will appear from the following example which will be described with reference to the accompanying drawings, in which:

FIGURE 1 diagrammatically illustrates a device according to the invention;

FIGURE 2 is a section A—A in FIGURE 1;

FIGURES 3*a* and *b* illustrate the functions of open and closed systems, respectively, according to the invention;

FIGURE 4 illustrates another embodiment of the invention, of which FIGURE 5 is an enlarged detail;

FIGURE 6 shows still another embodiment, of which FIGURE 7 is an enlarged detail.

Referring to FIGURE 1, the web-shaped packaging material **1** is advanced in the direction indicated by the arrow **2**. The web material slides across a base **3**. The base **3** has been shown only diagrammatically, although it may be given varying forms in details. For the purpose of reducing or eliminating the friction between the packaging material and the base and thereby pulls in the former, the base may thus consist of an endless band which moves at a speed and in a direction which agree with those of the packaging material **2**.

On the web material **1** there are liquid droplets **4**, which the method aims at removing. This takes place by means of a gas pressure producing member **5**, for example a centrifugal fan, blowing a sterilized gas, preferably sterile air, in the direction of the arrow **6** into a substantially cylindrical tube **7** provided with an air accelerator **8**. In the continuation it is assumed that sterile air will be used.

In addition to lateral walls in the plane of the paper, the air accelerator **8** has a top wall **10** and a bottom wall **11**. The walls **10** and **11** converge toward a slot **9** forming a nozzle for the air flow. Within the range of the nozzle the bottom wall **11** has its edge engaging the web of material **1**. The top wall **10** on the other hand merges with a wall **12**. From the air accelerator **8** an air flow which is uniform across the width of the packaging material, heavy, and directed slightly downward is pressed out through the nozzle **9**, said air flow blowing away liquid droplets on the packaging material **1** toward a liquid collector **17**.

From the liquid collector the liquid is carried away through a tube **18** or the like. On the other hand, the air which is still sterile flows up through the drum **13** in the direction of the arrow **14** and is returned to the centrifugal fan **5** through the inlet **15**. A certain leakage in connection with the blowing-off of the liquid from the web of material cannot be avoided, of course, whereby a minor portion of sterile air is lost. This lost air quantity is replaced by newly sterilized air, which is automatically supplied to the system through a sterilizer or air cleaner **16**. Possibly, a spring loaded valve **16** may be used instead.

FIGURE 2, which is a section A—A in FIGURE 1, illustrates more closely, how the sealing problem may be solved. A member **20**, made from a soft resilient material, for example glass fibre reinforced "Teflon"-cloth, engages the base **3** and prevents gas, i.e., sterile air, from passing out. The resilient member is fastened to the top wall **12** by upsetting the edges of the wall at **21**. In the direction of the arrows a sealing action is

also exerted by the air pressure within the space confined by the wall **12**, the members **20** and the packaging material **1**.

The method described has, among others, the following essential advantages. It is aseptic. It causes no undesirable pulling or guiding of the web of packaging material. It operates with sterile air which may be used several times without resterilization, whereby the method in addition becomes cheap.

Through the device a considerable amount of sterile air is transported per unit of time. The rate of flow is high in and immediately behind the nozzle **9**. Any mechanical particles (indicated by small spots), also including micro-organisms which may be found in the air, will under these conditions, when a device according to FIGURE 3*a* is used, strike the surface of the web of material to a substantially greater extent than stationary or relatively slowly flowing air. This is due partly to the fact that in the range of the nozzle a greater air quantity will contact the surface per unit of time, partly to the centrifugal force at the deflection of the pressure jet.

If instead a device according to FIGURE 1 or 3*b* is used, the air quantity flowing out from the nozzle is returned to the fan and is thus reused again and again. The system is closed. Only air possibly leaking out needs to be compensated. The circulation device according to the invention, with an air consumption reduced to a minimum, is therefore substantially more hygienic than a corresponding device with freely out-flowing air. FIGURE 3*a*. As only a small amount of air, namely said compensating amount, need to be sterilized, the total costs of the sterile method may be kept so low that the method and the device may actually be employed under commercial conditions.

In FIGURE 4 another embodiment of the invention is shown. Instead of a blower nozzle a suction nozzle **32** is used here, which sucks up the liquid droplets. The suction is caused by the heavy vacuum (indicated by minus signs, plus signs indicating overpressure) in the suction drum **32**, which leads to the fan intake **15**. On the output side of the fan an exhaust space **30** is provided from which the air is conducted down through a pressure drum **31** and the liquid is separated in a liquid separator **17**.

FIGURE 5 discloses more clearly how the range of the suction nozzle is intended to be designed. The suction nozzle **32** may consist of a narrow slot in a tube **34** from which a segment is sawn off along the whole length of the tube. The opening thereby formed toward the interior of the tube faces the suction drum **33**, whereby a heavy vacuum also arises within the tube **34** and its slot opening **32**.

The tube **34** may preferably be threaded or provided with flanges on its outside. These threads or flanges will serve as spacing members between the nozzle **32** and the web of material **1**.

Outside the nozzle **32** the sterile air shows an overpressure in the part of the device which forms part of the pressure drum **31**. Thereby air is prevented from entering the system from the environment. Instead a certain amount of sterile air will leak out between the paper web **1** and the wall **36**. This lost amount has to be compensated by new sterile air. On the other side of the nozzle the sterile air is prevented from leaking out and nonsterile air from leaking in through a spring wall **37** which sealingly engages the web of material.

In the device illustrated in FIGURES 6 and 7 both blowing and sucking are utilized for removing the liquid droplets. The principal parts of the device consist of

two substantially tubular members **40** and **41** disposed at right angles to the direction of movement of the paper web **1**. The two tublar members **40** and **41** communicate with each other by their end portions being connected through a fan, not shown, in such a way, that the tube **40** is connected to the inlet or vacuum side of the fan and the tube **41** is connected to the outlet or overpressure side. Furthermore, in the same way as in the eariler embodiments there are supply means for sterile air to the fan.

The tube **41** has an outlet in the form of a nozzle **42** which communicates with the tube **40** in a way analogous to that of the device according to FIGURE 1. The part of the tube **40** facing the paper web **1** is, as is to be seen most clearly from FIGURE 7, formed so as to present a member **43** which guides the air flowing out from the nozzle **42** up toward the top wall of the tube **40**. Above the member **43** a slot **44** is provided in the wall of the tube **40**. Under the influence of the rapidly flowing air there is, by ejector action, created a vacuum in the slot **44** in relation to the atmospheric pressure. Liquid droplets **4** present on the paper web will therefore be drawn up through the slot **44**. Droplets which are possibly not drawn up are subjected to the air flowing out through the nozzle **42** and are blown off.

The removed liquid quantity **17** is collected and removed through a tube **18** in the same way as before. By **45** a backup in the form of a deflection roller is designated. By the combination of suction and blowing a particularly high efficiency of the device is obtained, although the device may be made very simple in design.

That which is claimed is:

1. A method for removing aseptic sterilizing liquid from a web of packaging material without causing a pulling on the web material comprising the steps of: supplying a web of packaging material to a packaging machine with a sterilizing liquid on at least one face thereof, applying a sterile gas under pressure across the full width of said web as said web is introduced into said packaging machine to remove said sterilizing liqud from the face of said web, separating and collecting said removed sterilizing liquid from said sterile gas and recirculating said sterile gas to the pressure producing member.

2. The method according to claim **1** wherein said sterile gas is under a positive pressure.

3. The method according to claim **2** wherein said sterile gas is blown against the face of said web in a direction substantially opposite to the direction of travel of said web.

4. The method according to claim **1** wherein said sterile gas is under a negative pressure.

5. The method of claim **1** wherein additional sterile gas is added to the supply of sterile gas to compensate for sterile gas lost.

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